



Spectral Gamma-Ray Borehole Log Data Report

Page 1 of 3

Borehole

21-09-04

Log Event A

Borehole Information

| | | |
|-------------------------|----------------------------------|----------------------------------|
| Farm : <u>BX</u> | Tank : <u>BX-109</u> | Site Number : <u>299-E33-233</u> |
| N-Coord : <u>45,575</u> | W-Coord : <u>53,413</u> | TOC Elevation : <u>654.17</u> |
| Water Level, ft : | Date Drilled : <u>10/31/1973</u> | |

Casing Record

| | | |
|----------------------------|--------------------------------|--------------------|
| Type : <u>Steel-welded</u> | Thickness : <u>0.280</u> | ID, in. : <u>6</u> |
| Top Depth, ft. : <u>0</u> | Bottom Depth, ft. : <u>100</u> | |

Borehole Notes:

Borehole 21-09-04 was drilled in October 1973 to a depth of 100 ft with 6-in. casing. The casing thickness is presumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. steel tubing. A drilling log was not available for this borehole, so data from Chamness and Merz (1993) were used to provide construction information. Although no information concerning grouting or perforations was available, it is assumed that the borehole was not grouted or perforated since this was not a routine practice during the early 1970s drilling campaign. The top of the casing, which is the zero reference for the SGLS, is about 0.5 ft below the ground surface.

Equipment Information

| | | |
|-----------------------------------|---|--|
| Logging System : <u>2</u> | Detector Type : <u>HPGe</u> | Detector Efficiency: <u>35.0 %</u> |
| Calibration Date : <u>04/1997</u> | Calibration Reference : <u>GJO-HAN-13</u> | Logging Procedure : <u>P-GJPO-1783</u> |

Log Run Information

| | | |
|---------------------------------|----------------------------------|------------------------------------|
| Log Run Number : <u>1</u> | Log Run Date : <u>06/11/1997</u> | Logging Engineer: <u>Bob Spatz</u> |
| Start Depth, ft.: <u>0.0</u> | Counting Time, sec.: <u>100</u> | L/R : <u>L</u> Shield : <u>N</u> |
| Finish Depth, ft. : <u>27.5</u> | MSA Interval, ft. : <u>0.5</u> | Log Speed, ft/min.: <u>n/a</u> |
| Log Run Number : <u>2</u> | Log Run Date : <u>06/12/1997</u> | Logging Engineer: <u>Bob Spatz</u> |
| Start Depth, ft.: <u>100.0</u> | Counting Time, sec.: <u>100</u> | L/R : <u>L</u> Shield : <u>N</u> |
| Finish Depth, ft. : <u>26.5</u> | MSA Interval, ft. : <u>0.5</u> | Log Speed, ft/min.: <u>n/a</u> |
| Log Run Number : <u>3</u> | Log Run Date : <u>06/12/1997</u> | Logging Engineer: <u>Bob Spatz</u> |
| Start Depth, ft.: <u>26.0</u> | Counting Time, sec.: <u>100</u> | L/R : <u>L</u> Shield : <u>N</u> |
| Finish Depth, ft. : <u>11.0</u> | MSA Interval, ft. : <u>0.5</u> | Log Speed, ft/min.: <u>n/a</u> |



Borehole

21-09-04

Log Event A

Analysis Information

Analyst : E. Larsen

Data Processing Reference : MAC-VZCP 1.7.9

Analysis Date : 12/03/1997

Analysis Notes :

This borehole was logged by the SGLS in three log runs. Two log runs were required to log the borehole. An additional log run was performed to repeat an interval of the borehole as a quality check. The pre-survey and post-survey field verification spectra for all logging runs met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

The man-made radionuclide Cs-137 was detected in this borehole. The Cs-137 contamination was detected continuously from the ground surface to 31.5 ft. An isolated occurrence of Cs-137 was detected at the bottom of the logged interval (100 ft).

An analysis of the shape factors associated with applicable segments of the spectra was performed. The shape factors provide insights into the distribution of the Cs-137 contamination and into the nature of zones of elevated total count gamma-ray activity not attributable to gamma-emitting radionuclides.

Most of the U-238 concentration values are absent between 6 and 8.5 ft. The K-40 concentration values increase from 38.5 to 42.5 ft and generally remain elevated to a depth of 59 ft. The K-40 concentrations increase slightly from 59 to 60 ft and remain elevated to the bottom of the logged interval. Elevated U-238 and Th-232 concentration values occur at about 41 and 60 ft.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Reports for tanks BX-106 and BX-109.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

The interval between 11 and 26 ft was relogged as a quality assurance measure to establish the repeatability of the radionuclide concentration measurements. The radionuclide concentrations shown were calculated using separate data sets provided by the original and rerun logging runs.



Spectral Gamma-Ray Borehole
Log Data Report

Page 3 of 3

Log Event A

Borehole

21-09-04

A plot of the spectrum shape factor is included. The plots are used as an interpretive tool to help determine the radial distribution of man-made contaminants around the borehole.